Exploring the impact of social relationships on teachers' use of research: A regression analysis of 389 teachers in England

Professor Chris Brown, University of Portsmouth
Dr. Dell Zhang, Senior Lecturer, Birkbeck, University of London
Mr. Nan Xu, Birkbeck, PhD student, University of London
Mr Stephen Corbett, Head of School, University of Portsmouth

Corresponding author:

Professor Chris Brown
Professor of Education
University of Portsmouth
School of Education and Childhood Studies
St George's Building
141 High Street
Old Portsmouth
PO1 2HY

(e) chris.brown@port.ac.uk
(t) 02392 845245

1. Overview

Research-informed teaching practice refers to the use of research evidence by teachers in order to improve how they teach and, as a result, student learning outcomes. The use of research by teachers is considered both beneficial and desirable (a situation we describe as optimal rational). As such, research-informed teaching should be both encouraged and facilitated. At the same time we are still to discover the most effective ways of supporting and fostering teachers' engagement with research. In light of the increasing focus on social influence as a driver of behaviour/behavioural change, with this paper we examine the extent to which social-influence affects teachers' use of research (via the impact social influence has on the benefits, costs, and signification teachers associate with research-use). Furthermore we also examine the relative importance of social influence compared to other factors known to positively affect research use: 1) teachers' perceptions as to whether they work in a trusting work environment; 2) perceptions as to whether school leaders' encourage the use of research in their schools; and 3) teachers' perceptions regarding whether they are encouraged to innovate. To investigate the impact of social influence on teachers' research-use a regression model using survey and social network data from 389 teachers from 42 primary schools in England was constructed.

2. The power of social influence

It is now widely acknowledged that social influence can have a material impact on people's attitudes and behaviours: in other words our choices and decisions and our opinions and beliefs are more often than not influenced others (Berger, 2016). It is also clear that social influence can assert itself a number of ways including: 1) through implicit norms and guidelines that govern our understanding of how to respond in specific situations (Berger, 2016); 2) individuals can rely on the judgement of others when they are uncertain, meaning that the views of groups in such situations can converge (Asch, 1956); 3) similarly individuals can also use the behaviour of others as a source of information to guide how to act – or as Berger observes, as 'a heuristic that simplifies decision making' (2016: 29) (with Berger providing a myriad of examples to illustrate this point, ranging from where we park our car to how we decide which school to send our children to); and 4) that people often feel social pressure to confirm with the decisions or behaviour of the wider group (Berger, 2016).

But social influence doesn't always result in convergence: depending on the activity, social influence can also lead to individuals engaging in behaviour to differentiate themselves from others. Most notably once an item of clothing, a TV show or a make and model of car becomes 'too' popular, or is adopted by particular demographic groups it can result in others then liking it less (again see Berger, 2016; for specific examples). Furthermore similarities in the beliefs or behavior of connected individuals can actually represent a different phenomenon – that of homophily. Here shared similarities in relation to certain attributes simply occur because 'birds of a feather to flock together' rather than due to any inherent behaviour change (Daly, 2010). As such, when considering social influence, it is important to ascertain the both the direction and cause of correlated behaviour to determine what might be due to social influence, which way social influence is directing people and what role (if any) homophily is playing.

For our purposes it is also important to differentiate between formal and informal forms of social influence that exist within organisations, with the latter involving alternative forms of influence and leadership (Daly, 2010). In particular, while formal relationships within organizations can be identified and mapped out though organagrams, the informal organization should be conceived of more as a 'social network'. In other words, as an entity comprising groups of social actors "who are connected to one another through a set of different relations or ties" (Daly, 2010: 4). The presence of informal social networks within organizations provides an alternative means through which social capital, i.e.: 'communication, ideas, knowledge, innovation, or any number of resources can flow through [the ties that exist] between actors' (ibid). Since resources can flow through social networks, they can be accessed and harnessed. Often the influence deriving from these social networks is substantial as key aspects of an organisation's culture is derived from them. While the hierarchical organization structure may be seen to position a managerial power structures, this are often not the only driver for culture and in turn change. Johnson, et al's (2008) 'cultural web' highlights the influential factors in an organization's paradigm. Correspondingly, unlike formal hierarchies, where power results from one's position within the organization, with networks informal social influence accrues to those actors most able to successfully harness resource and/or control resource flow to others. The interplay between formal and informal influence is key to how change occurs within organizations. For instance it is argued by Spillane *et al.,* (2010) that, given the influence that operates through social networks, it is informal leaders – those with connections to many other actors and most able to harness/control the resource flow that results – who are most likely to determine the fate of new initiatives or reforms. In this paper, therefore, we focus on informal social connections and influence.

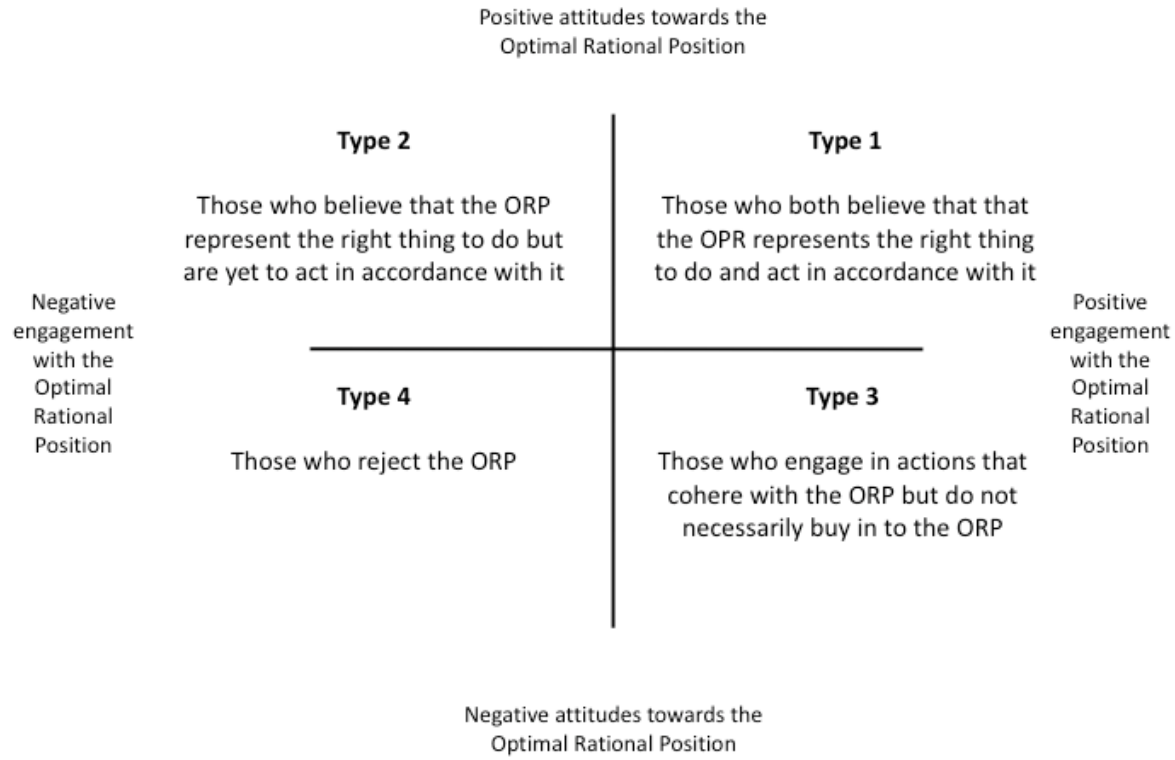
3. Optimal Rational Positions

The concept of optimal rational positions (ORPs) represents the idea that there are certain acts, states or situations that society deems beneficial – generally these benefits accrue in terms of the longer term and in relation to the wider population. For example the need to reduce carbon emissions to minimize the impacts of climate change is an ORP, as is the need for us to eat five items of fruit and vegetables a day. Other examples of ORPs include the suggestion that we should limit our alcohol consumption to 14 units per week[i] and that we should exercise for 30 minutes at least three times a week. In terms of how they might be recognized or defined, Optimal Rational Positions typically emerge as a result of four key factors: factor 1) a robust and credible evidence base in relation to current or potential new behaviours; factor 2) a well-reasoned argument (or theory of change) which provides this evidence with meaning; factor 3) a social, moral or value-based imperative setting out the need for change based on this meaning (or conversely, the consequences of not changing); and factor 4) buy-in to this imperative from a range of credible stakeholders (these will be later illustrated using the example of Research-informed teaching practice below).

Underpinning this paper are two key arguments in relation to ORPs. The first is that, because they comprise of a pragmatic coalescence of hard facts with a general desire to improve people's lives, Optimal Rational Positions present us with a substantive requirement to engage in change. Second, we should want to pursue ORPs because they espouse the types of behaviours that will enable us to live healthier, happier or more productive lives; that can improve the lives and outcomes of others; or that can help us ensure social and/or environmental sustainability. At the same time the concept of optimal rationale behavior – of which ORPs form part - accepts that people may not necessarily pursue ORPs because of the freedom we have to choose what we believe in, how we act and the many goals we may seek to aim for (factors that are likely to resonate with personal values and aspects of the self we are seeking to realise: Sartre, 2013).

Understanding that sometimes individuals may know about ORPs but not engage in actions that cohere with them, or, may reject ORPs also helps to illustrate the notion of 'rationality gaps'. This is because it enables us to consider people's responses to Optimal Rational Positions according to their attitudes towards the ORP and their engagement with it. In other words whether: 1) individuals believe that the ORP is something that reflects how they and others should be behaving; and 2) whether they are indeed acting in accordance with the ORP. Assuming that both beliefs/attitudes and actions can be assigned to the dichotomous categories of 'yes' or 'no' then this specific division of attitudes and actions can be represented by the 2 x 2 matrix set out in Figure 1 below:

Figure 1: Rationality types



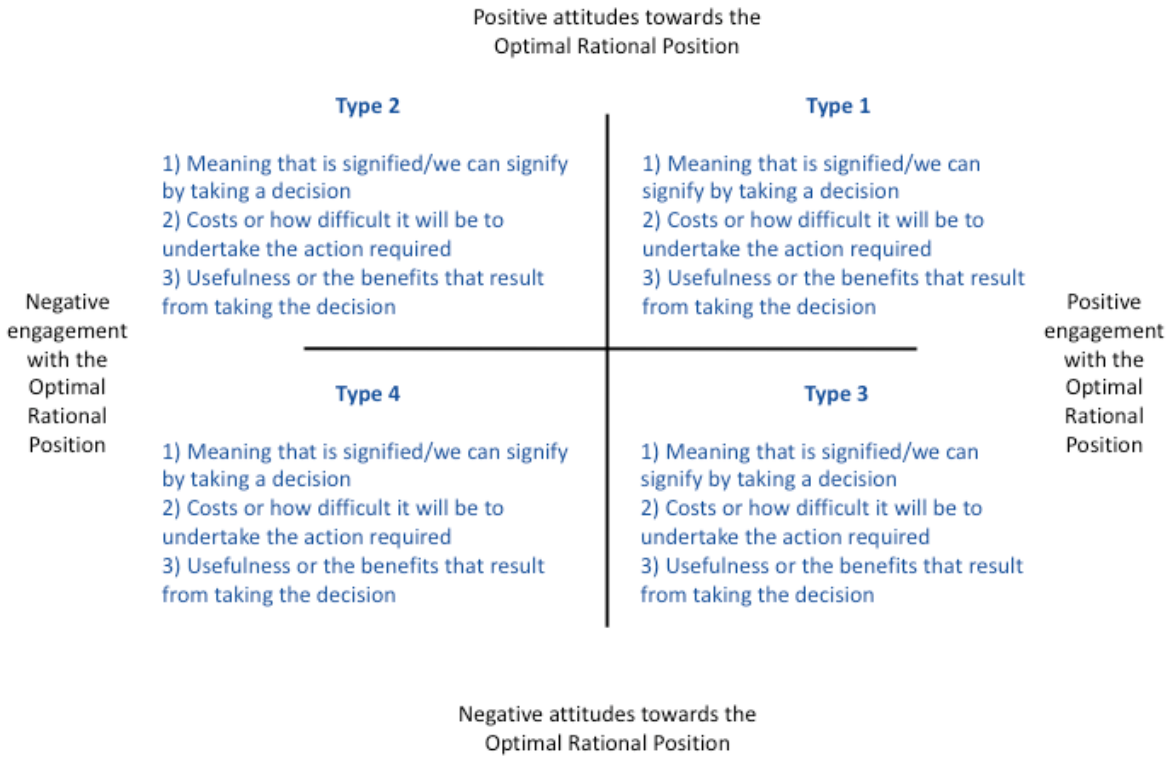
Correspondingly we can begin to consider individuals as belonging to one of four types as relates to any given ORP. Here 'Type 1' individuals are those that believe that that the OPR represents the right thing to do and act in accordance with it. In other words Type 1 individuals are achieving the Optimal Rational situation of maximising welfare (i.e. welfare for the long term self or long term universal). 'Type 2' individuals are those who believe that the ORP represent the right thing to do but are yet to act in accordance with it: for instance they may lack required knowledge, skills or resource to fully engage with the ORP. Type 2 individuals may also require a greater incentive to move away from

engaging in more preferential activities (typically those that benefit the short term self). 'Type 3' individuals do engage in actions that cohere with the ORP but do not necessarily buy in to the ORP. This may mean, for example, that the fact that their actions cohere with the ORP is simply coincidence or that their actions are driven by other factors (such as budget restraints). Alternatively it may mean that while they previously thought the ORP was a good thing they no longer believe this to be the case. Thus the coherence of the actions of 'Type 3' individuals with the ORP is only likely to be temporary. Finally 'Type 4' individuals totally reject the ORP.

As a result of allocating people to the types set out in Figure 1 we can determine whether rationality gaps exist: in other words we can ascertain whether outcomes could be more objectively beneficial than they currently are. This is because it is only 'Type 1' individuals who maximise wellbeing. Rationality gaps in essence therefore represent the proportional differences between those people who might be considered 'Type 1' and all others (i.e. those who could potentially be 'Type 1'). Key to filling rationality gaps, meanwhile, is understanding the relationships that exist between people and things, such as objects and ideas. It is through relationships that things are afforded significance. Correspondingly, understanding people's behaviour in relation to Optimal Rational Positions requires researchers to develop a rich understanding of the meaning an ORP has for people's lives. In particular researchers should consider: 1) what the ORP 'signifies' to individuals, and what individuals believe engaging with an ORP enables them to signify to others; 2) the benefits individuals perceive will result from acting in accordance with an ORP; and 3) cost, and whether individuals can 'afford' to, or will find it difficult to act in ways required by the ORP (Baudrillard, 2018; Brown, 2018).

Adding this notion of benefits, costs and signification to the matrix set out in Figure 1 (above) now provides a framework that can be used to develop a more in-depth understanding of why people respond to ORPs in different ways. By exploring what is perceived by different people when they consider ORPs we can begin to understand the essential variations in their perceptions of meaning, usefulness and cost: why an ORP can be seen as attractive, useful and easy to attain to one set of individuals and not to another. Furthermore, why individuals may prefer to choose alternatives to the ORP. This is illustrated in Figure 2 below. We can also begin to explore what factors or phenomenon might alter what is signified and, correspondingly, the likelihood that people will engage with the ORP. As such this paper we introduce the idea of social influence to that of ORPs to argue that our perception of the benefits, costs and signification associated with actions or objects may well be dependents on the benefits, costs and signification that our social connections ascribe to these things.

Figure 2: Incorporating semiotic analysis into the Optimal Rational matrix



4. Research-informed teaching practice

Research informed teaching practice (RITP) represents a collaborative process in which teachers and school leaders work together to access, evaluate and apply the findings of academic research in order to improve teaching and learning in their schools (Walker, 2017). There is now a longstanding recognition by both teachers and policy-makers that academic educational research can be used to improve practice but only limited evidence on how this might be facilitated at the school level (Graves and Moore, 2017). Furthermore, a systemic level gap appears to exist between research and practitioners which as yet shows little indication of narrowing (Buske, and Zlatkin-Troitschanskaia, 2018; Coldwell *et al.,* 2017; Graves and Moore, 2017; Whitty and Wisby, 2017). As a result this leaves only sporadic instances of RITP occurring within and across schools; with other factors such as intuition and experience instead solely driving much of the decision making undertaken by teachers (Buske, and Zlatkin-Troitschanskaia, 2018; Vanlommel *et al.,* 2017). Yet at the same time RITP very much represents an Optimal Rational Position and so should be encouraged and fostered within schools. RITP as ORP is illustrated below using the four factors that comprise ORPs. To recall these are: factor 1) a robust and credible evidence base in relation to current or potential new behaviours; factor 2) a well reasoned argument/theory of change which provides this evidence with meaning; factor 3) a social, moral or value-based imperative setting out the need for change based on this meaning; and factor 4) buy-in to this imperative from a range of credible stakeholders

Factor 1: Collaborative RITP can have positive benefits for both teachers and students. For example, correlational data reported by Mincu (2014) suggests that where research is used as part of high quality initial teacher education and ongoing professional development, it is associated with higher teacher, school and system performance (similar relationships are also reported in Godfrey; 2014). More recently Rose and colleagues (2017), using a randomized control trial across a sample of 119 schools, showed that increased levels of collaborative research use by primary school teachers had a

significant impact on primary school student's exam results. CUREE (2010), meanwhile, lists a range of positive teacher outcomes that emerge from collaborative RITP including both improvements in pedagogic knowledge and skills, and greater teacher confidence.

Factor 2: A theory of change for why RITP should improve teaching and student outcomes is set out in Brown *et al.,* (2017). Broadly this argues that there is a multitude of research that currently exists that can help teachers in a number of areas of their work. For example research can be used to: 1) aid teachers in the design of new bespoke strategies for teaching and learning in order tackle specific identified problems; 2) provide teachers with ideas for how to improve aspects of their day to day practice by drawing on approaches that research has shown to be effective; 3) help teachers expand, clarify and deepen their own concepts, including the concepts they use to understand students, curriculum and teaching practice, and; 4) provide teachers with specific programs or guidelines, shown by research to be effective, which set out how to engage in various aspects of teaching or specific approaches to improve learning. Thus, if teachers are able to engage with this research in a way that enables them to undertake any of 1-4) above, their teaching quality should be improved. Correspondingly, improved teaching quality should then lead to improved student outcomes.

Factor 3: Given that it is possible to use research evidence to improving teaching practices then teachers *should* engage in RITP. This imperative stems from advocates such as Oakley; who argues that evidence-informed approaches ensure that "those who intervene in other people's lives do so with the utmost benefit and least harm" (2000: 3). Oakley thus contends that there exists a moral imperative for practitioners to only make decisions, or to take action, when armed with the best available evidence. In other words that: "we [all] share an interest in being able to live our lives as well as we can, free from ill-informed intervention and in the best knowledge we can gather of what is likely to make all of us most healthy, most productive, most happy and most able to contribute to the common good" (2000: 323). More recently Goldacre (2013) also argued that teachers *should* engage in RITP since it would lead not only to improved outcomes for children but also increased professional independence (resulting in teaching experiencing an 'enhanced' level of professionalization akin to that of doctors). Likewise England's *Chartered College of Teaching* recently suggested that teachers engagement with research should be viewed as the hall mark of an effective profession.[ii]

Factor 4: It is evident that there now exists a general position in favour of teachers pursing collaborative RITP. For instance the direction of travel of recent educational policy in England and elsewhere (including for example, Australia, Netherlands, Norway, Ontario, and the USA,) focuses strongly on promoting, assisting and requiring teachers to better engage with research (Coldwell *et al.,* 2017; Whitty and Wisby, 2017). It is also apparent from recent announcements by organizations, such as the Education Endowment Foundation (EEF), who in 2014 launched a £1.4m fund to improve the use of research in schools (EEF 2014) and in 2016 launched the *Research Schools* initiative.[iii] In addition, this position can be associated with the rise of bottom up/teacher led initiatives, such as the emerging network of 'Teachmeets'[iv] and 'ResearchED'[v] conferences (Whitty and Wisby, 2017) designed to help teachers connect more effectively with educational research. One recent prominent example of such teacher led initiatives was the 2017 launch of England's Chartered College of Teaching: an organization led by and for teachers in order to support the use of evidence-informed practice (Whitty and Wisby, 2017). In addition to the macro-environment influence we must remember there is a significant requirement for buy-in at an individual school level. The key for the success of this is related to the formal and informal power structures within each school. If those who are key social actors and influencers in the school (i.e. credible stakeholders) support the value of RITP its use will become an accepted part of the school's culture. This will support the longevity and sustainability of RITPs use and impact.

Furthermore two qualitative studies undertaken by Brown (see Brown, 2018) investigating this area, highlight some of the benefits, costs and signification-related factors that teachers associate with RITP: in other words some of the factors that need to be addressed to close rationality gaps and encourage individuals to engage in RITP. These include:

Benefits

1. A general belief by many interview respondents that the regular use of research to inform practice *results in better outcomes for children and students*;
2. It was felt that engagement with research through the use of learning conversations with other teachers enabled respondents to *engage in new ideas that could potentially lead to improvements in practice.* Also that engaging with research in such conversations provided a beneficial way of *challenging entrenched practice* that might not always be effective;
3. An *enquiry mindset* held by some respondents demonstrated they *felt able to experiment* and that they knew *how to experiment [and were happy to take warranted risks]*, thus maximizing the *use* value they might get from research; and
4. A *networked mindset* held by some respondents highlighted that they knew where to turn to for RITP related support. Respondents also *knew where to go to access research;* i.e. they could identify who and where they might turn to in order to access research papers, articles and books. This mindset thus meant that respondents could more readily access the benefits of RITP.

Costs

1. Time-related costs featured strongly and include: time to engage in RITP meaningfully and effectively (and the recognition that more could be done with more time); the time required to access and source good quality research; time to develop a research-informed approach; time to understand how to engage in new practices until they become fully integrated into teaching activities; likewise the time required to explain to others – such as teaching assistants – what any new practices are and how they impact on current ways of working; and finally, the time required to share (or broker) research or RITP with other colleagues so that they could benefit from it).
2. Respondents not currently using research also expressed concerns in terms of whether they would be able to access and understand formal academic research.
3. A number of teachers also expressed concern that RITP was not supported generally within their school either by teachers or by school leadership, thus making it harder for them to engage effectively.
4. Related to both points 1 and 3 was the perception that *competing priorities* – including accountability drivers, such as school inspections - could often take precedence over RITP.

Signification: Signification varied according to teacher type (see Figure 1, above). In particular, Type 1 teachers typically saw RITP as something that signaled the presence of *reflective, empowered teachers who constantly improve their practice.* For example in Brown (2018) type 1 teachers' responses to the question "when I say research informed teaching, what image does that convey to you?" included: 'an research-informed teacher is someone that has the confidence to open themselves up to being challenged'; 'a reflective teacher. A teacher that's really challenged themselves to improve'; and 'its having the confidence to change things, and to look at things and to take that [research] onboard and to change the way you are working'. This stood in stark contrast to Type 4 teachers (rejecters) who linked RITP directly to *performativity and accountability*: i.e. a managerial lever through which to control, discipline and potentially punish teachers who failed to deliver. Type 2 teachers meanwhile generally recognized that RITP *provided a route to better practice;* likewise Type 3 teachers suggested RITP represented a *useful tool* which *provides a route to better student outcomes* and as providing the basis for confident professional autonomy.

5. How social relationships might influence RITP

Although we have an understanding of some of the benefit, costs and signification factors that are associated with RITP, a question still remains in terms of what might positively influence these in order make RITP an everyday reality in schools (Brown, 2018; Coldwell *et al.,* 2017). As Wentworth *et al.,* (2017) observe, schools are social structures in which norms and values that help determine actions and behaviors. Recalling section 2 above (which examined the power of social influence), it seems likely that social factors could positively affect the benefits, costs and signification associated with RITP (which in turn will make it more likely that teachers will engage in the optimal rational position of RITP). For instance if we know and witness our colleagues* engaging in research use, we are likely to have more opportunity to see benefits of RITP, realize how to overcome any perceived costs, as well as possibly perceive that 'this is the way things should be done around here'. In other words if our colleagues are doing something, this is often likely to signal that this activity is something we ourselves can and should be doing. Conversely, the absence of these things could potentially make research-informed teaching practice less likely (Spillane *et al.,* 2010). The aim of this paper therefore is to explore the importance of social influence on teachers' engagement in RITP. Specifically the paper will explore whether teachers are more likely to use research to improve their practice depending on whether the teachers they have an informal social connection with engage in RITP (or not). The main hypothesis to be tested by this paper therefore is:

> ***H1:*** *There is a positive relationship between teachers' use of research to inform their practice and their colleagues'* use research to inform their practice.*
>
> *here the term colleague is referring to an individual a teacher has an informal social connection with

At the same time it is extant studies suggest a number of other factors could potentially affect teachers use of research via an impact on the benefits, costs and signification-related factors that teachers associate with RITP (Coldwell *et al.,* 2017; Brown, 2018). As such, as well as examining the existence and direction of any relationship between teachers' use of research and that of their colleagues, we also examine the relative importance of relational influence in comparison to the following factors:

1) a trusting work environment: In high trust schools, individuals feel supported to engage in risk taking and the innovative behavior associated with efforts at developing or trialing effective practice in a 'safe' learning environment (also Bryk and Schneider, 2002; Stoll *et al.,* 2006; Mintrop and Trujillo, 2007). It is of no surprise therefore that trust between and amongst educators also likely to support professional efforts related to the use of research evidence (Brown *et al.,* 2016; Finnegan and Daly, 2012). For instance, a trusting work environment is instrumental to the type of 'double-loop' learning that is key to fostering RITP (Argris and Schön, 1996): that is, a trusting environment will be a prerequisite if teachers are to openly and collaboratively challenge and question their foundational assumptions as part of a process of seeking to continually improve teaching and learning. Furthermore since effective research use is dependent on capacity (ability) to engage with research evidence, trust can mediate between those with and without such capacity. In other words where teachers feel they do not have the knowledge or skills to challenge a research-informed position, trust enables that position to be widely adopted (Finnigan and Daly, 2012). As such it seem that, in terms of benefits, costs and signification, high trust environments signal that it is OK to take risks, lower the costs of doing so and make risk-taking a potentially more beneficial activity. A second hypothesis that will be tested therefore is that:

H2: *There is a positive relationship between teachers' use of research to inform their practice and their perception that they work within* a high trust environment.

2) an environment that encourages research-use: If it is to be 'the way things are done around here', research-use needs to become a cultural norm within schools. Such norms are likely to stem from a full commitment to research-informed practice from school leaders who, drawing on forms of transformational leadership, can establish a vision for their school that supports and encourages research use. In addition school leaders should also provide the necessary resource and structures (e.g. time and space) for sustained, meaningful and collaborative research-use to become a reality (Buske, and Zlatkin-Troitschanskaia, 2018; Coldwell *et al.,* 2017; Leithwood *et al.,* 2006). Although these efforts are important, for a formal research use environment to have impact teachers must also possess mindets that are specifically geared towards ways of working that support RITP: i.e. mindsets where there is a belief in the value of research-evidence and RITP, as well as valuing the systems and structures that are required to facilitate RITP (Wentworth *et al.,* 2017). Furthermore teachers need to believe in the benefits of working collaboratively and the role of collaborative processes (such as learning conversations) in developing RITP (Brown, 2017; Wentworth *et al.,* 2017). An encouraging research-use environment is thus most likely to positively influence teachers' use of research through its effect on the signification associated with RITP (with the presence of time and space - if provided - potentially also reducing perceived costs). If, despite this top down encouragement, teachers still do not believe in the benefits of RITP or its costs are still perceived to be too high, then RITP will still fail to take hold. Nonetheless a third hypothesis to be tested is:

H3: *There is a positive relationship between teachers' use of research to inform their practice and their perception that they are encouraged to engage in RITP*.

3) an innovative school environment: RITP is also more likely to materialize when school cultures that are attuned to innovation. This may occur, for instance, through school leaders promoting the benefits of considering innovative ideas and normalizing the notion of experimenting with new ways of working (Coldwell *et al.,* 2017; Leithwood *et al.,* 2006). Likewise, RITP will be more likely to occur when school leaders facilitate a supportive environment within which new practice can be developed, trialed and evaluated (Stoll *et al.,* 2006). As with trusting work environments, innovative environments signal that it is OK to take risks, lower the costs of doing so and make risk-taking a potentially more beneficial activity. At the same time this does not automatically mean that RITP will be adopted – this again depends on the benefits, costs and signification that teachers associate engaging with research in comparison to other approaches to innovation (e.g. engaging in joint practice development activities such as lesson study or the use of alternative evidence bases such as school data). It is more likely that RITP will materialize in innovative environments than not, however, and so a fourth hypothesis to be tested is that:

H4: *There is a positive relationship between teachers' use of research to inform their practice and their perception that they work in an innovative school environment*.

4) homophilly: finally for the purpose of this paper we argue that research use by teachers is unlikely to be caused by homophilly as this would require teachers to actively chose their working environment based on whether other teachers hold similar research-use attitudes and behaviors to themselves. As has been shown in Brown (2018), however, individual schools as well as school federations can contain a myriad of teacher types (i.e. Types 1-4 in Figure 1). This suggests that homophilly is therefore unlikely to play a major role outside of our main hypothesis (H1, above). Correspondingly, we do not examine its influence here.

Finally it should be noted that there is an assumption inherent within this analysis that teachers can effectively engage with research. In other words that teachers can access, evaluate and apply the findings of academic research in order to improve teaching and learning in their schools (Walker, 2017). We believe this assumption is justified. For example both findings in Coldwell *et al.,* (2017) and Brown (2018) note that although teachers aren't always confident to read research in the form of journal articles, they are comfortable with engaging in teacher friendly research syntheses such as the Education Endowment Foundation's 'Teacher Toolkit' of Hattie's (2008) 'Visible Learning'.

6. Methods and analysis

The research presented here forms part of a wider project examining the use of research by teachers (the *Research Learning Communities project* funded by the Education Endowment Foundation). As part of this study a social network survey was administered to all teaching staff within participating schools. A total of 828 teachers from 43 primary schools participated in the survey, resulting in an average response rate of 75%. Table 1 provides the overall demographics of the participating teachers from the 43 schools. As can be seen, schools involved had on average some 320 students (SD = 194.4) with approximately 19 teachers per school (SD = 10.5). The average schools' OfSTED grade[vi] is close to the accountability outcome level of "Good" (SD = 1.2). As for teacher data, of all the 828 teachers, 82% are female; approximately 49% serve as a subject leader (e.g., math lead or coordinator; and about 18% hold a formal and senior leadership position (e.g., headteacher). On average, the teachers have less than four years of experience working in their current position.

Table 1: Sample Demographics

	Mean or %	SD
School level		
Number of teachers	19.00	10.50
Number of students	320.00	194.38
OfSTED	2.86	1.17
Teacher level		
Years in current position	3.56	3.71
Gender (female)	82.0%	--
Serve as a subject leader	49.0%	--
Hold a formal senior leadership role	18.0%	--

It should be noted that the demographic data does highlight a number of caveats in relation to how our analysis can be interpreted. First, all of the schools involved are primary schools, so no inference can be made about this analysis and England's 3,200+ secondary schools. Second, due to their desire to take part in the Research learning Communities Project, it is possible that the schools involved are more predisposed to research engagement than the majority of England's primary schools.[1]

In addition to the demographic data, to explore hypothesis 1, we collected social network data in order to determine the informal professional relationships that existed between teachers in the surveyed schools. Here we asked participants to assess the *frequency* of interactions with other colleagues of their school in relation to a number of different interaction types, using on a 5-point scale ranging from 1 (1-2 times a week) to 5 (Not at all) (see Table 3). In addition to the frequency of

[1] 20 of the schools in our sample were in a Teaching School Alliance, where there is a formal commitment to engage with research and development and another 20 were attempting to enter a research alliance.

their teaching and learning-related interactions, we also asked participants to assess the *quality* of such interactions by reflecting the degree of usefulness on a 5-point scale, ranging from 1 (Not at all useful) to 5 (Very useful). Participants within each school received a roster with teachers from their schools in rows and the frequency of interactions for each relationship in columns. The number of nominations from the bounded list of nominees that participants could make was unlimited. This bounded method is a social network strategy that provides a more complete picture of the network and thus supports valid results (Scott, 2000).

To understand participants' use of research to inform their teaching-practice as well to explore the three questions relating to hypotheses 2-4 above we employed the perception scales set out in Table 2 below. Each question in Table 2 employed a five point Likert scale which ranged from 'Strongly Agree' to 'Strongly Disagree'.

Table 2: Survey questions employed

Hypothesis	**RITP area**	**Survey questions**	**Shorthand reference**
Dependent variable & hypothesis 1	Use of research	Information from research plays an important role in informing my teaching practice	r-practice
2	A trusting work environment	Staff in this school trust each other	Overall_Trust
3	An environment that encourages research-use	My school encourages me to use research findings to improve my practice	Encouragement
4	An innovative school environment	My school experiments with new ways of working	Experimentation

For our analysis we assumed teachers' use of research (r-practice) was our dependent variable. Our aim therefore was to understand the interplay between r-practice and the factors that potentially influenced research-use represented in the hypotheses above), i.e.: 1) their colleagues' use of research (represented by the 'r-practice' scores for those individuals respondents had social ties with; 2) whether participants' perceived they worked in a trusting environment (Overall_Trust); 3) whether teachers perceived that they worked in an environment that supports research use (Encouragement); and 4) whether teachers perceived their school encourages them to experiment with new ways of working (Experimentation). A regression model was developed to examine the existence and nature of the relationship between dependent and causal variables. The model can be formally expressed as equation 1, below:

$$R\text{−}Practice\_I = f(R\text{−}PracticeC, Encouragement\_I, Experimentation\_I, Overall\_Trust\_I)$$

I: myself,
C: colleague.

To construct and evaluate the model, a Python program was written to process and generate the analysis result. Furthurmore, to study social network structure, we have programmed a function within our Python program using NetworkX library, which is an open-source software for complex

networks, to create a social network graph model for each school based on the 10 different interaction categories, which are listed in Table 3.

Table 3: Interaction categories used in the school survey

Prefixes	Description
ETL_F_	expertise in teaching and learning frequency
ETL_Q_	expertise in teaching and learning quality
SRBA_F_	sought research based advice frequency
SRBA_Q_	sought research based advice quality
ETM_F_	exchanged teaching materials frequency
JEPW_F_	Jointly evaluated pupils' performance/work frequency
CWT_F_	Collaborated regarding improving teaching practice frequency
CF_F_	Regard as a close friend frequency
VT_F_	Vent to frequency
IN_F_	Consider to be an energy 'infuser' frequency

Based on these network graph models, 389 valid individual teacher data entries, which are illustrated in table 4, were extracted by matching the teacher names from each school's social network data to the master survey results. In Table 4, the values from left to right in the first matrix are the other teachers' (neighbours) R-practice mean in the given teacher's individual school, the other teachers' (neighbours) R-practice standard deviation in the given teacher's individual school, the given teacher's own encouragement Likert scale point, the given teacher's own Experimentation Likert scale point and finally, the given teacher's own Overall-Trust Liker scale answer. In the second vector, the values is the given's teacher's own R-practice Liker scale point. All of the Liker scale points were transformed into numerical integers format with values range from -2 to 2.

$$\begin{bmatrix} 1.57142857 & 0.53452248 & 2. & 2. & 2. \\ 1.66666667 & 0.51639778 & 1. & 1. & 2. \\ 1.6 & 0.54772256 & 2. & 2. & 2. \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0.75 & 0.46291005 & 2. & 2. & 1. \\ 1. & 0.63245553 & 1. & 1. & 2. \\ 0.90909091 & 0.70064905 & 2. & 2. & 0. \end{bmatrix} \begin{bmatrix} 1. \\ 1. \\ 2. \\ \vdots \\ 1. \\ 0. \\ 1. \end{bmatrix}$$

Table 4: post-processed data samples.
The value from left to right in left Matrix are: R-Practices_N_mean, R-Practices_N_STD, Encouragement_I, Experimentation_I and Overall-trust_I. The value in right vector is R-Practices_I

Because data was collected via Likert scale points and these type of data do not have a specified probability distribution, we therefore employed nonparametric statistical model and relevant data mining methods, i.e, Random Forests [Breiman 2001] and Stochastic Gradient Boosting [Friedman 2002] for this analysis task and applied 5-fold cross-validation technique on the data samples to evaluate these predictive models. After comparison, we opted to use the Stochastic Gradient Boosting approach since it was able to provide higher prediction accuracy 0.601498 (by Gradient Tree Boosting classifier) vs 0.565601 (by Random Forests classifier) with similar standard deviation 0.072290 vs 0.065734 correspondingly. The result also indicates that the performance of this prediction model is stable and consistent due to low standard deviation among the 5-fold tests, and the accuracy of predicting unknown R-practices_I value by given new R-practices_C, Encouragement_I,

Experimentation_I and Overall-Trust_I values is around 60%. Finally, we computed the feature importance scale for each causal variables in our model to exam the previously defined four relationship hypotheses. The result is illustrated in Table 5.

Table 5: Feature Importance Scale

Rank	Features	Importances
1	Encouragement I	0.3725364
2	R-practice_C_STD	0.2363432
3	R-practice_C_Mean	0.2179004
4	Experimentation_I	0.1197469
5	Overall_trust_I	0.0534729

7. Results

The results show that all of the factors tested (R-practices_C, Encouragement_I, Experimentation_I and Overall-Trust_I) do have some influence on R-practices_I. This means that all four of our hypotheses should be accepted. At the same time, however it is clear that the most influential factors by far are 1) perceptions by teachers that their school encourages them to use research findings to improve their practice; and 2) the extent to which the an individual teacher's colleagues (i.e. those they have social ties to) report that research plays an important role in informing their teaching practice. Further investigating the significance of social influence, we can also see that the standard deviation score for R-practices_C is close to its mean suggesting that the strength of this relationship was common across all 42 schools. To cross-check our prediction accuracy, we applied an Ordinal Regression method using mord library software. In this test, we obtained a very similar accuracy result. Furthermore we also computed the assortativity coefficient r for the previously created weighted social networks based on the R-practice attribute as the early result implies a high degree of assortative mixing for this attribute. The assortativity coefficient r is a measure of similarity or difference between connected nodes' degree in the network and this value is normally between -1 and 1. Due to the small node size, each school social network r value is less than 0 which indicate the disassortative mixing. But after increased node size by combining all individual networks into a single large network, we obtained a new r value indicating the assortativity which is same as our predicted result. In other words, by aggregating all teachers into one large matrix we could see that the impact of R-practices_C was similar across all teachers.

8. Discussion

The principal argument of this paper is that RITP is an optimal rational position and so is something to be encouraged and facilitated. As we note above, achieving ORPs requires us to attend to the benefits, costs and signifying aspects individuals associate with them. There is now a growing recognition that social influence can affect people's behaviour. When viewed through the lense of Optimal Rationality this is because of our perceptions of the benefits, costs, and signification associated with a given ORP can be influenced by others. With this paper we have attempted to assess whether social influence therefore affects the use of research by teachers. Furthermore to explore whether such influence is relatively more powerful than other factors thought to be associated with teachers' using research (and which can also potentially influence the benefits, costs and signifying aspects associated with RITP), i.e.: perceptions of a trusting work environment; perceptions of an innovative work environment; and perceptions that schools leaders are encouraging the use of research in schools (Coldwell *et al.,* 2017; Brown, 2018).

The findings from our regression model reinforce what was previous known about the importance of school leader encouragement for RITP if it is to become the 'way things are done around here' (Buske, and Zlatkin-Troitschanskaia, 2018; Coldwell *et al.,* 2017; Leithwood *et al.,* 2006). They

likewise confirm that trusting and innovative working environments do matter. Vitally, however, our findings also provide new understanding in terms of the importance of social influence in supporting the realization of RITP. Specifically they show that not only can social influence positively encourage RITP, but that such influence appears to be relatively important as a driver for teachers' use of research. Our findings regarding the importance of social influence can be partially explained by previous qualitative work in this area: for example the two studies by Brown (2017; 2018) detailed earlier. In relation to these it seems clear that social and relational factors can help promote RITP by: 1) providing teachers with the opportunities to engage in research-informed learning conversations in which new innovations are shared and potentially ineffective practices challenged; 2) ensuring that teachers know who to turn to in order to access research or seek RITP related support; and 3) ensure RITP is regarded as a supported and meaningful endeavour that is regarded as personably desirable but also professionally expected. Furthermore our findings can also be reflected by extant research into RITP which focuses the relational aspects of school improvement. For example studies which highlight the roles of social structures, norms and values in helping determine effective and appropriate actions and behaviors (e.g. Wentworth *et al.,* 2017).

At the same time our findings also point to a key challenge for policy-makers and educational leaders if RITP is to become a reality in school systems. Namely, if our use of research is greatly influenced by our colleagues' use of research, then how can systemic and whole school research-use be 'kick started'? In other words how do we switch on the idea that everyone is now using research? One way to address this may be to consider which individuals are best placed to influence perceptions as to the take up of RITP within a school. We note in section 2 that informal social relations within a school are often best thought of as a social network through which social capital resources (such as information and advice) flow. At the same time social capital tends to be unevenly distributed within networks (Spillane *et al.,* 2010). Correspondingly if we explore who it is that teachers turn to for work related expertise, and then identify which of these individuals is turned to most, we will have likely pinpointed the teacher(s) most able to disseminate social capital resource to others. What's more, if this individual (or individuals) is also centrally positioned in other areas (e.g. in terms of a school's trust or support networks) then they can potentially also galvanize other teachers to adopt new practices such as RITP. As such, to mobilize RITP we suggest that, as well as encouraging research use from the top down, school and school system leaders should also begin to use social network approaches to identify teacher 'opinion formers'. Once identified these teachers should then by utilised as part of any drive to mobilize opinion and the adoption of RITP. In other words school and system leaders should harness the social influence opinion formers possess in order to help make the optimal rational position of RITP a reality.

References

Argris, C. and Schön, D. (1996) *Organisational learning II: Theory, Method, Practice, Increasing Professional Effectiveness*, (San Francisco, CA, Jossey Bass).

Asch, S. (1956) Studies of independence and conformity: a minority of one against a unanimous majority, *Psychological Monographs*, 70, pp. 1-70.

Baudrillard, J. (1968) *The System of Objects*, (London, Verso).

Berger, J. (2016) Invisible influence: the hidden forces that shape behaviour, (New York, NY, Simon & Schuster).

Breiman, L. (2001) Random Forests, *Machine Learning*, 45, 1, pp 5-32.

Brown, C. (2018) *How social science can help us make better choices: Optimal rationality in action,* (London, Emerald).

Brown, C., Daly, A. and Liou, Y-H. (2016) Improving Trust, Improving Schools: Findings from a Social Network Analysis of 43 Primary Schools in England, *Journal of Professional Capital & Community,* 1, 1, pp. 69-91.

Brown, C., Schildkamp, K. and Hubers, M. (2017) Combining the Best of Two Worlds: A Conceptual Proposal for Evidence-Informed School Improvement, *Educational Research,* 59, 2, pp. 154-172.

Bryk, A. and Schneider, B. (2002) *Trust in schools: A core resource for school improvement,* (New York, NY, Russell Sage Foundation).

Buske, R. and Zlatkin-Troitschanskaia, O. (2018) Investigating principals' data use in school: The impact of evidence-oriented attitudes and epistemological beliefs, *Educational Management Administration & Leadership*, early online access.

CUREE (2010) Report of Professional Practitioner Use of Research Review: Practitioner engagement in and/or with research, (Coventry: CUREE, GTCE, LSIS & NTRP). Available at: http://www.curee-paccts.com/node/2303, accessed on 24 December, 2017

Coldwell, M., Greany, T., Higgins, S., Brown, C., Maxwell, B., Stiell, B., Stoll, L, Willis, B. and Burns, H. (2017) Evidence-informed teaching: an evaluation of progress in England (London, Department for Education).

Daly, A. (2010) Mapping the terrain: social network theory and educational change, In Daly, A. (ed) *Social Network Theory and Educational Change*, (Cambridge, MA, Harvard Education Press).

Finnigan, K.S. and Daly, A.J. (2012) Mind the gap: organizational learning and improvement in an underperforming urban system, *American Journal of Education*, 119, 1, pp. 41-71.

Friedman, J H (2002), Stochastic gradient boosting, *Computational Statistics & Data Analysis*, 38, 4, pp 367-378.

Godfrey, D. (2014) Leadership of schools as research-led organizations in the English educational environment: cultivating a research engaged school culture, Educational Management Administration & Leadership, early online publication.

Goldacre, B. (2013) *Building Evidence into Education* (London, Department for Education). Available from: https://www.gov.uk/government/news/building-evidence-into-education, accessed on 10 September 2017.

Graves, S. and Moore, A. (2017) How do you know what works, works for you? An investigation into the attitudes of school leaders to using research evidence to inform teaching and learning in schools, *School Leadership & Management*, early online access

Hattie, J. (2008). *Visible Learning: A Synthesis of over 800 Meta analyses Relating to Achievement (*Abingdon, Routledge).

Johnson, G; Scholes, K; Whittington, R. (2008). *Exploring Corporate Strategy (8th Ed.). (*Harlow, Financial Times Prentice Hall)

Leithwood, K., Day, C., Sammons, P., Harris, A. and Hopkins, D (2006) *Successful school leadership: what it is and how it influences student learning. Research report 800,* (London, DfES).

Mincu, M. (2014). Inquiry paper 6: teacher quality and school improvement – what is the role of research? In the British Educational Research Association/ The Royal Society for the encouragement of Arts, Manufactures and Commerce (Eds), *The Role Of Research In Teacher Education: Reviewing The Evidence*, retrieved from https://www.bera.ac.uk/wp-content/uploads/2014/02/BERA-RSA-Interim-Report.pdf, accessed on November 8th 2017.

Mintrop, H. and Trujillo, T. (2007). The practical relevance of accountability systems for school improvement: A descriptive analysis of California schools, *Educational Evaluation and Policy Analysis*, 29, pp. 319–352.

Oakley, A. (2000) *Experiments in knowing: gender and method in the social sciences*, (Cambridge, Polity Press).

Rose, J., Thomas, S., Zhang, L., Edwards, A., Augero, A. and Rooney, P. (2017) *Research Learning Communities: Evaluation report and executive summary (December 2017)*
Available at:
https://educationendowmentfoundation.org.uk/public/files/Projects/Evaluation_Reports/Research_Learning_Communities.pdf, accessed on December 15th 2017.

Sartre, Jean-Paul (2013) *Existentialism and Humanism*, (York, Methuen).

Scott, J. (2000) Social Network Analysis (2nd ed) (Sage, London).

Spillane, J., Healey, K. and Kim, C. (2010) Leading and managing instruction: formal and informal aspects of elementary school organization, In Daly, A. (ed) *Social Network Theory and Educational Change*, (Cambridge, MA, Harvard Education Press).

Stoll, L., Bolam, R., McMahon, A., Wallace, M. and Thomas, S. (2006) Professional learning communities: a review of the literature, *Journal of Educational Change*, 7, 4, pp. 221-258.

Vanlommel, K., Van Gasse, R., Vanhoof, J. and Van Petegem, P. (2017) Teachers' decision-making: Data based or intuition driven, International Journal of Educational Research, 83, pp. 75-86.

Walker, M. (2017) *Insights into the Role of Research and Development in Teaching Schools* (Slough, NfER).

Wentworth, L., Mazzeo, C. and Connolly, F. (2017) Research practice partnerships: a strategy for promoting evidence-based decision making in Education, *Educational Research*, 59, 2, pp. 241-255.

Whitty, G. and Wisby, E. (2017) Is evidence-informed practice any more feasible than evidence-informed policy? Presented at the British Educational Research Association annual conference, Sussex, 5 -7 September, 2017,

[i] See: https://patient.info/health/recommended-safe-limits-of-alcohol

[ii] See: https://chartered.college/chartered-teacher-professional-principles

[iii] See: https://educationendowmentfoundation.org.uk/our-work/research-schools/

[iv] See: http://www.teachmeethants.co.uk/sample-page/

[v] See: http://www.workingoutwhatworks.com

[vi] OfSTED is England's school inspectorate